

# Activities and Achievements of the Photovoltaic Southeast Regional Experiment Station

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## ABSTRACT

The Photovoltaic Southeast Regional Experiment Station (SE RES) was established as a U.S. Department of Energy testing and evaluation laboratory in September 1982. The Florida Solar Energy Center, a research institute of the University of Central Florida, operates the SE RES at its campus in Cocoa, Florida. During its 19-year history, Sandia National Laboratories has provided technical liaison and oversight for SE RES activities.

SE RES activities fall into one or more of the following six categories:

- Laboratory testing and evaluation
- Monitoring grid-tied photovoltaic systems
- Practitioner training and certification
- Applications and market development
- Technical assistance
- Education and information dissemination

This paper summarizes activities and achievements in each of the above categories.

## 1. Laboratory Testing and Evaluation

As part of the SE RES cooperative agreement with the U.S. DOE, FSEC has tested and evaluated modules, arrays, inverters, batteries, charge controllers, lighting components, and systems (grid-tied, stand-alone and hybrid). In the summer of 2001, FSEC received formal accreditation as a quality laboratory (for testing both photovoltaic and solar thermal hardware) by the American Association for Laboratory Accreditation (A2LA). This important accreditation means that FSEC meets the "General Requirements of Testing and Calibration Laboratories" (ISO/IEC 17025) and operates in accordance with international quality standards (ISO 9001). In addition to A2LA accreditation, FSEC is currently pursuing accreditation from PowerMark Corporation, the U.S. agent for the Photovoltaic Global Approval Program (PV GAP). With PowerMark accreditation, FSEC will test, certify and rate the performance of photovoltaic modules; review, approve and certify grid-tied photovoltaic system designs; and test and certify stand-alone photovoltaic systems.

The most significant recent achievements of the SE RES in laboratory testing and evaluation have been: 1) A2LA accreditation as a quality testing laboratory, 2) the testing and performance rating of over 15 different models of photovoltaic modules from various suppliers, 3) the review

and approval of over 25 grid-tied system designs, 4) the development of procedures for hardware certification of photovoltaic modules, grid-tied photovoltaic systems, and stand-alone photovoltaic systems, and 5) laboratory improvements for implementing the hardware certification program in anticipation of achieving PowerMark accreditation.

## 2. Monitoring Grid-Tied Photovoltaic Systems

Over 50 grid-tied photovoltaic systems have been instrumented over the past two years and are currently being monitored for performance, reliability and operating costs. Three levels of monitoring are being used: simple metering, time-of-day, and research. The least expensive type of monitoring is simple metering using a watt-hour meter at the output of the inverter. Typically, utility partners read the meters monthly and report the data to FSEC. Performance anomalies are detected by comparing normalized monthly energy output among various systems in the same general vicinity.

Time-of-day monitoring of photovoltaic power output is of interest to many utilities. Utilities are interested in quantifying the aggregate value of various penetration levels of photovoltaic systems on their distribution networks, especially during peak demand periods. This work is in the early stages of development and will take several years before sufficient information and analyses are available for prudent business planning by utilities.

Research level monitoring usually involves new or advanced products or designs. Parameters are measured to determine the performance of photovoltaic components and systems, and sometimes the performance of building components. Results are shared with industry to improve product performance and reliability. They are also shared with photovoltaic system suppliers and with building professionals to improve designs and building integration techniques.

The most significant recent achievements of the SE RES in system monitoring have been: 1) contributions of performance, reliability and cost data to Sandia National Laboratories' qualified database, 2) the identification of inverter reliability problems that would have otherwise gone unnoticed without monitoring, 3) the development of the FSEC Photovoltaic Systems Data Network, which provides answers and useful information to potential customers over the Internet, and 4) the use of photovoltaic databases to enhance K-12 science education.

### 3. Practitioner Training and Certification

Practitioner training and certification are high priorities within the SE RES program. Along with hardware certification, practitioner certification can help ensure customers that the photovoltaic products they purchase will meet their expectations.

Practitioner certification is a credential awarded to the practitioner indicating that minimum core competency standards have been met. Assessments of knowledge, skill and experience are used to determine if the practitioner meets these standards. FSEC has used an accepted process for certification and has developed specific recommendations on certification requirements, standards, testing, education and training. The steps in the process, combined with specific recommendations on certification requirements, standards, testing and training constitute a model that has been submitted to the North American Board of Certified Energy Practitioners (NABCEP).

To establish practitioner certification standards, FSEC developed a detailed task analysis. The task analysis lists all core knowledge and skills that a practitioner must have to install a grid-tied photovoltaic system. Each task was given a priority (high, medium, or low) based on both the chance of error and the consequence of error in performing the task. The combination of the tasks, their priorities, the conditions under which the tasks are performed, and the criteria used to determine successful completion of the tasks were used to develop the recommended standards. Test items and checklists to be used in determining competency have also been developed and are currently under review for validity and reliability.

To prepare practitioners for certification, FSEC has developed a one-week training program on installing grid-tied photovoltaic systems. The training is based on the same task analysis used for certification. Over 100 photovoltaic installers have been trained and tested by FSEC over the last three years. During the summer of 2001, FSEC was audited by the Institute for Sustainable Power and became the first organization to receive ISP Training Institution and Master Trainer (Jim Dunlop) accreditation.

The most significant recent accomplishments of the SE RES to practitioner training and certification have been: 1) the training, testing and authorization of over 100 photovoltaic installers from around the nation, 2) significant enhancement of training facilities and materials, 3) development of recommended certification requirements, 4) development of a comprehensive and prioritized task list, which has been reviewed (seven iterations) by industry and other subject matter experts, 5) development of recommended certification standards, 6) development of over 300 test items and associated checklists for assessing competency, 7) development of a model for practitioner certification presented at a national workshop in Sacramento, California on September 30, 2001, and 8)

accreditation in two categories by the Institute for Sustainable Power.

### 4. Applications and Market Development

Applications and market development are the primary goals of the Florida Photovoltaic Buildings Program. As part of this program, nine application experiments and value propositions have been developed for targeted end users. Rebates of \$4 per watt have been administered by FSEC as part of this program, and the offering of green pricing by several Florida utilities is imminent. Four quality control measures have been developed and implemented in conjunction with the rebate program. Special efforts have been made to combine rooftop PV systems with energy efficient buildings, manufactured buildings and model homes.

The most recent significant achievements of the SE RES in this area have been: 1) the development and dissemination of a model photovoltaic buildings program, including six workshops for MSRI partnerships in other states, 2) formation of utility partnerships and a commitment by them to install approximately 4 MW of distributed photovoltaic systems over the next several years, 3) successful implementation of four separate quality measures as part of a larger quality control program, 4) the matching of state buy-down funds by municipal utilities at a ratio of four to one, 5) adoption of over 15 FSEC recommendations on interconnection requirements by the Florida Public Service Commission, and 6) development and dissemination of important publications on lessons learned and cost reduction strategies.

### 5. Technical Assistance

Technical assistance activities are usually performed in response to specific requests and include the following: project development and implementation; energy assessments; site surveys and assessments; development of procurement specifications; field inspections; and special workshops. Major projects have involved energy assessments with the National Park Service at Horn Island, MS, Ft. Jefferson, Loggerhead Key, Katmai National Park, Everglades National Park, and Denali National Park. In addition, technical assistance has been provided to organizations and individuals at a rate of approximately six per month.

### 6. Education and Information Dissemination

Major on-going activities in this area include: workforce development through the pursuit of degree, diploma and certificate programs with vocational-technical institutions; standards-based curricula for K-12 education; teacher training programs; web-based information dissemination; and public outreach programs.